

APTERYGOTA OF THE WILLIAMS GALAPAGOS EXPEDITION

By J. W. FOLSOM.

(Plates III-V incl.).

The Apterygota collected by the Williams Galapagos Expedition sent out by the Department of Tropical Research, of the New York Zoological Society, and forming the subject of the present report, are as follows:

Heterolepisma intermedia sp. nov.

Acrotelsa galapagoensis Banks.

Lepidocyrtus intermixtus sp. nov.

The two species of Thysanura were collected by Professor W. M. Wheeler, and the single species of Collembola by Mr. William Beebe.

Types and other specimens are in the collections of the Department of Tropical Research of the New York Zoological Society.

Five species of Apterygota are now known from the Galapagos Islands, the Hopkins Stanford Expedition, 1898-1899, having taken three species, which were described by Mr. Nathan Banks. One of these three (*Acrotelsa galapagoensis* Banks) was present in the Williams collection, but the two others (*Lepisma insularis* Banks and *Machilis mutica* Banks) were not.

***Heterolepisma intermedia* sp. nov.**

(Plate III, figs. 1-8; Plate IV, figs. 9-12).

Dorsally grayish or brownish with the scales; ventrally whitish; body color yellowish white. Legs whitish or spotted with brown or purplish, with yellow setae. Head short and broad. Thorax in width to height as 10:7; thoracic nota subequal; pronotum not strongly narrowing anteriorly, subquadrate with rounded angles. Body elongate, almost parallel-sided throughout, sub-cylindrical, dorsally strongly convex. Abdomen narrowing but slightly posteriorly, almost twice as long as the thorax (as 13:7). Tenth urotergite (figs. 1, 2) four times as long as the ninth, trapezoidal, with posterior angles rounded and posterior margin slightly concave. Antennae white, spotted with brown or purplish, the spots forming annulations in large specimens; length of antennae unknown.

First form on press February 27, 1924.

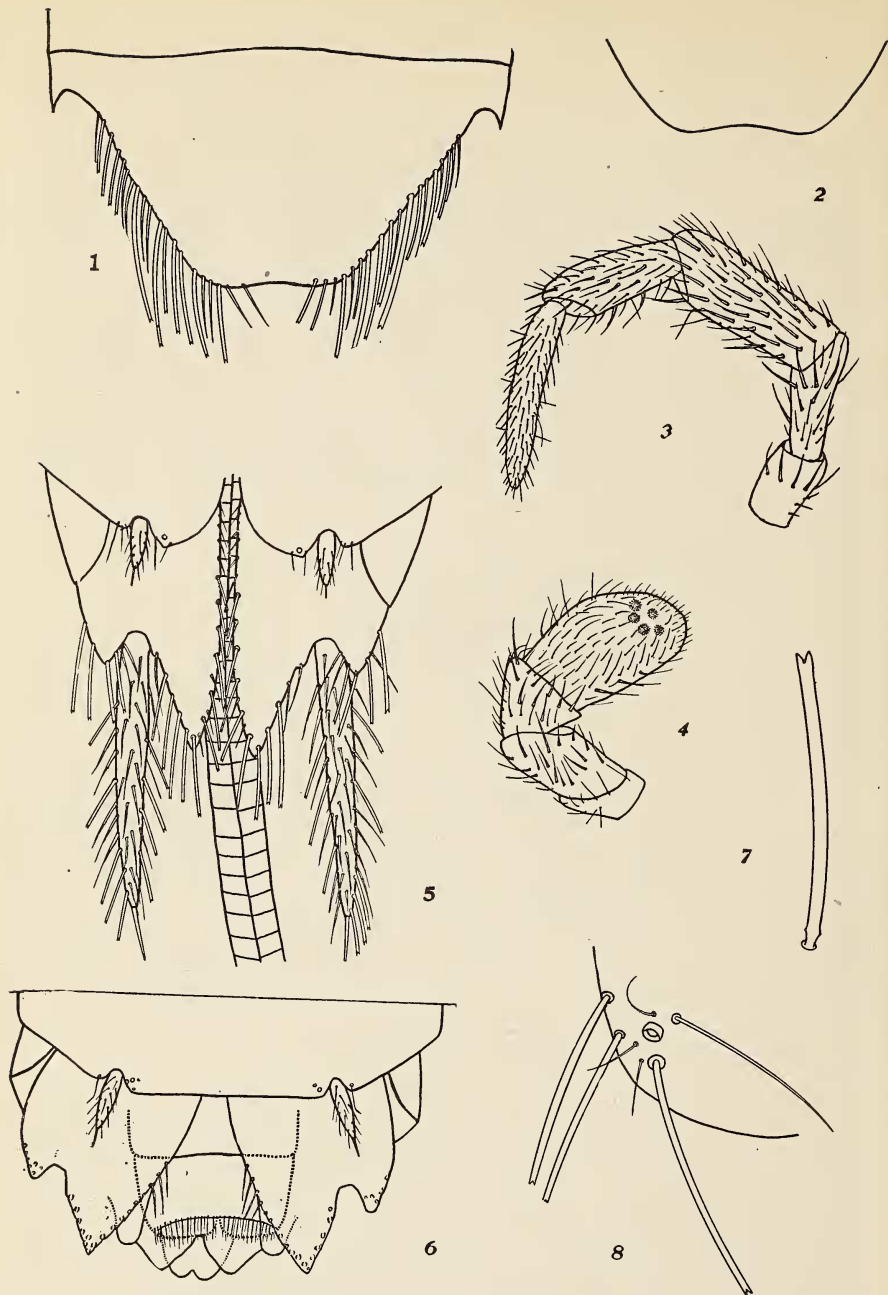


Plate III. 1, *Heterolepisma intermedia*, telson of female, $\times 80$. 2, *Heterolepisma intermedia*, extremity of telson of male, $\times 80$. 3, *Heterolepisma intermedia*, right maxillary palpus, $\times 100$. 4, *Heterolepisma intermedia*, left labial palpus, $\times 100$. 5, *Heterolepisma intermedia*, ventral aspect of extremity of abdomen of male, $\times 53$. 6, *Heterolepisma intermedia*, ventral aspect of extremity of abdomen of female, $\times 53$. 7, *Heterolepisma intermedia*, seta from front, $\times 370$. 8, *Heterolepisma intermedia*, setal cluster of left postero-lateral angle of pronotum, $\times 175$.

Palpi whitish, tinged with brown or purplish, with yellow setae. Maxillary palpi (fig. 3) with last four segments pigmented apically. Labial palpi (fig. 4) with last three segments pigmented faintly; last segment stout, subclavate, with five rounded papillate sense organs (fig. 4). Cerci of unknown length. Styli (fig. 5) two pairs, on eighth and ninth abdominal segments, respectively; white with yellow setae; styli of ninth segment long and large; those of the eighth small. Ovipositor (fig. 5) rod-like, tapering apically, extending beyond the paramedian processes a distance equal to four times the length of the latter; dorsal and ventral valves pseudosegmented. Paramedian processes (fig. 5) each extending not quite to the middle of the adjacent stylus; shorter and broader in the male (fig. 6) than in the female. Eighth urosternite undivided in the male (fig. 6).

All the setae are naked. Most of the setae of the head and body are bilobed apically (fig. 7), straight or slightly curving, and of different sizes. They are numerous on each side of the front, on the sides of the head, above the bases of the antennae, and on the posterior part of the abdomen. On the lateral margins of the thorax are sparse short setae, with occasional long setae. Each thoracic notum has 2 + 2 setal clusters or combs: at each postero-lateral angle a cluster (fig. 8), and on each side of the posterior margin a comb consisting of one macrochaeta between two small setae. Abdominal segments one to seven, inclusive, bear 3 + 3 setal combs: inner dorsal, outer dorsal and lateral (figs. 9-11); abd. 8, 2 + 2, dorsal and lateral; abd. 9 and 10, none. The macrochaetae of the combs are reduced in number as compared with those of most other species. Thus the inner dorsal comb has but one large seta between two small ones (fig. 9); the outer dorsal, two or three macrochaetae (fig. 10); and the lateral comb, two (fig. 11). Ventrally, abdominal segments two to seven, inclusive, bear 1 + 1 combs, each comb consisting of two (rarely three) macrochaetae between two small setae (fig. 12). On the eighth abdominal segment there is one (sometimes two) macrochaeta on the mesal side of the articulation of the stylus (figs. 5, 6). In the specimens most of the macrochaetae of the clusters and combs had fallen off, but were represented by their sockets, as shown in the figures.

Scales oval, orbicular, suboblong, subelliptical, etc., being very variable in form; very finely striate; pale brown or colorless.

Length, 5.5 mm.; width, 1 mm.

Eleven syntypes. Indefatigable, April 19th, under roots of *Bursera*, five males and four females, W. M. Wheeler (No. 2262). South Seymour, April 22nd, sifted from soil near beach, one male and one female, W. M. Wheeler (No. 2297).

In its generic characters this species is intermediate between *Isolepisma* Esch. and *Heterolepisma* Esch. It agrees with the former genus in its arched dorsum and long telson, and with the latter in its subquadrate pronotum, scarcely narrowed anteriorly, and the general character of its setal clusters and combs. It seems preferable to refer this species to *Heterolepisma*, rather than to erect a new genus for it.

H. intermedia is nearly related to the neotropical species *H. pampeana* Silv., recorded from Buenos Aires, Rio S. Cruz and Porto Piramides, and reported to be abundant on the pampas of Patagonia.

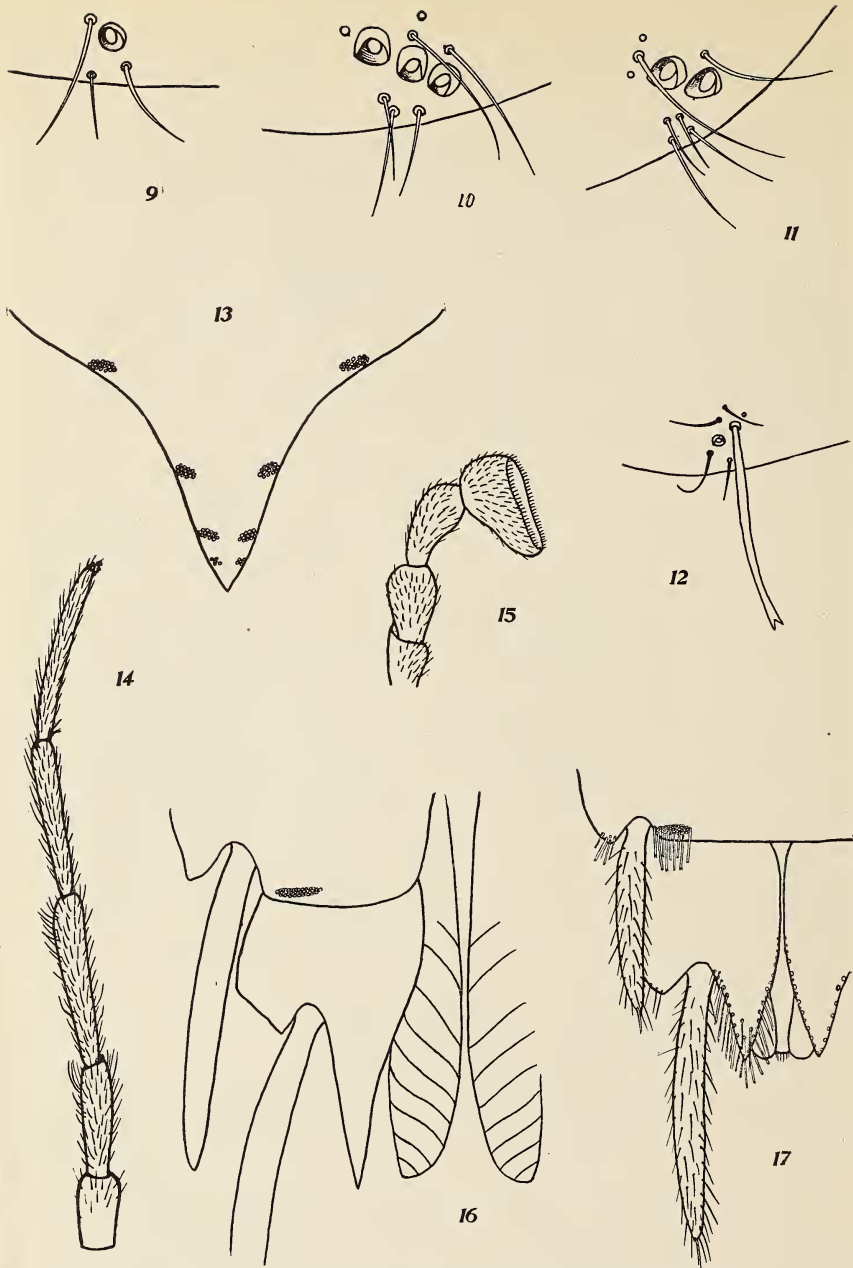


Plate IV. 9, *Heterolepisma intermedia*, right inner dorsal setal cluster of the third abdominal segment, $\times 370$. 10, *Heterolepisma intermedia*, right outer dorsal setal comb of the fifth abdominal segment. The macrochaetae are represented only by their sockets, $\times 370$. 11, *Heterolepisma intermedia*, right lateral setal comb of the third abdominal segment, $\times 370$. 12, *Heterolepisma intermedia*, right ventral setal comb of the sixth abdominal segment, showing one of the two macrochaetae, $\times 175$. 13, *Acrotelsa galapagoensis*, telson of female, $\times 25$. 14, *Acrotelsa galapagoensis*, left maxillary palpus of female, $\times 25$. 15, *Acrotelsa galapagoensis*, left labial palpus of female, $\times 20$. 16, *Acrotelsa galapagoensis*, ventral aspect of extremity of abdomen of female, $\times 25$. 17, *Acrotelsa galapagoensis*, ventral aspect of extremity of abdomen of male, $\times 34$.

Acrotelsa galapagoensis Banks.*Lepisma galapagoensis* Banks, 1901.*Proc. Wash. Acad. Sc.*, Vol. 3, pp. 541-543, figs. 47-50.

(Plate IV, figs. 13-17; Plate V, figs. 18-20).

This giant lepididid described by Banks was represented in the collection by five specimens, the study of which has enabled me to add certain details to the original description.

Dorsally dark brown; mottled with dark brown, pale brown or grayish scales; body color white. Ventrally silvery white; or with yellowish white thorax and brownish abdomen. Legs golden brown proximally, pale yellow distally, with brown scales and yellow or yellowish brown setae. Head short and broad, rounded anteriorly; eyes not prominent. Thorax broader than the abdomen; pronotum rounded laterally, narrowing anteriorly. Abdomen narrowing slightly posteriorly. Tenth urotergite (fig. 13) elongate-subtriangular, apically acute, fringed with stiff yellow setae. Antennae longer than the head and body by one third; annulated with dark brown and white. Maxillary palpi (fig. 14) white with brown setae (female) or brownish with last three segments darker (male); with segments in relative lengths as 3:5:7.5:7:8 (female) or as 3:5:7:5:13 (male). The fifth segment in Bank's figure is probably abnormally short. Labial palpi (fig. 15) white with brown setae (female) or pale brown (male); last segment foot-shaped. Cerci and pseudocercus dark brown, annulated with white or yellowish white; the former three fourths as long as the head and body; the latter somewhat longer than the cerci. Styli (figs. 16, 17) seven pairs, on third to ninth abdominal segments; slender, white with brown setae (female) or brownish with golden brown setae (male). Dorsal and ventral valves of ovipositor subequal in length. Ventral valves (fig. 16) finger-shaped in ventral aspect, obliquely pseudosegmented, extending almost as far as the adjacent paramedian process of the ninth gonocoxite; this process (figs. 16, 17) tapering uniformly to an acute apex, and extending two fifths as far as the adjacent (last) stylus in the female, and one third as far in the male. Eighth ventral segment divided in the female, forming a pair of gonocoxites (fig. 16), undivided in the male (fig. 17). Seventh ventral segment (fig. 18) undivided, rounded posteriorly, without a median fold on the posterior margin. Parameres of male (fig. 17) subclavate, extending as far as the adjacent paramedian processes of the ninth abdominal segment.

Stiff, minutely fringed setae, apically bilobed (fig. 19) occur abundantly; most of them being yellow, though some are brown. On the head are "fourteen tufts of hair seen from above as follows: one in front of each eye, one behind each antenna, two above base of each antenna, one in front of each antenna, and two each side on anterior margin; below on clypeus there are other tufts" (Banks). Marginal clusters of these bilobed setae occur on the thoracic terga, occupying the yellowish pores mentioned by Banks. Each thoracic notum bears seven or eight lateral clusters of setae, the last cluster being at the postero-lateral angle, and bears in addition, near the posterior margin, 1 + 1 dorsal combs. The combs are simply clusters in which the setae are in alignment, as in figure 17. On the abdomen, in dorsal aspect, the following setal combs or clusters are visible: abd. 1, 2 + 2; abd. 2-7, 3 + 3; abd. 8, 2 + 2; abd. 9,

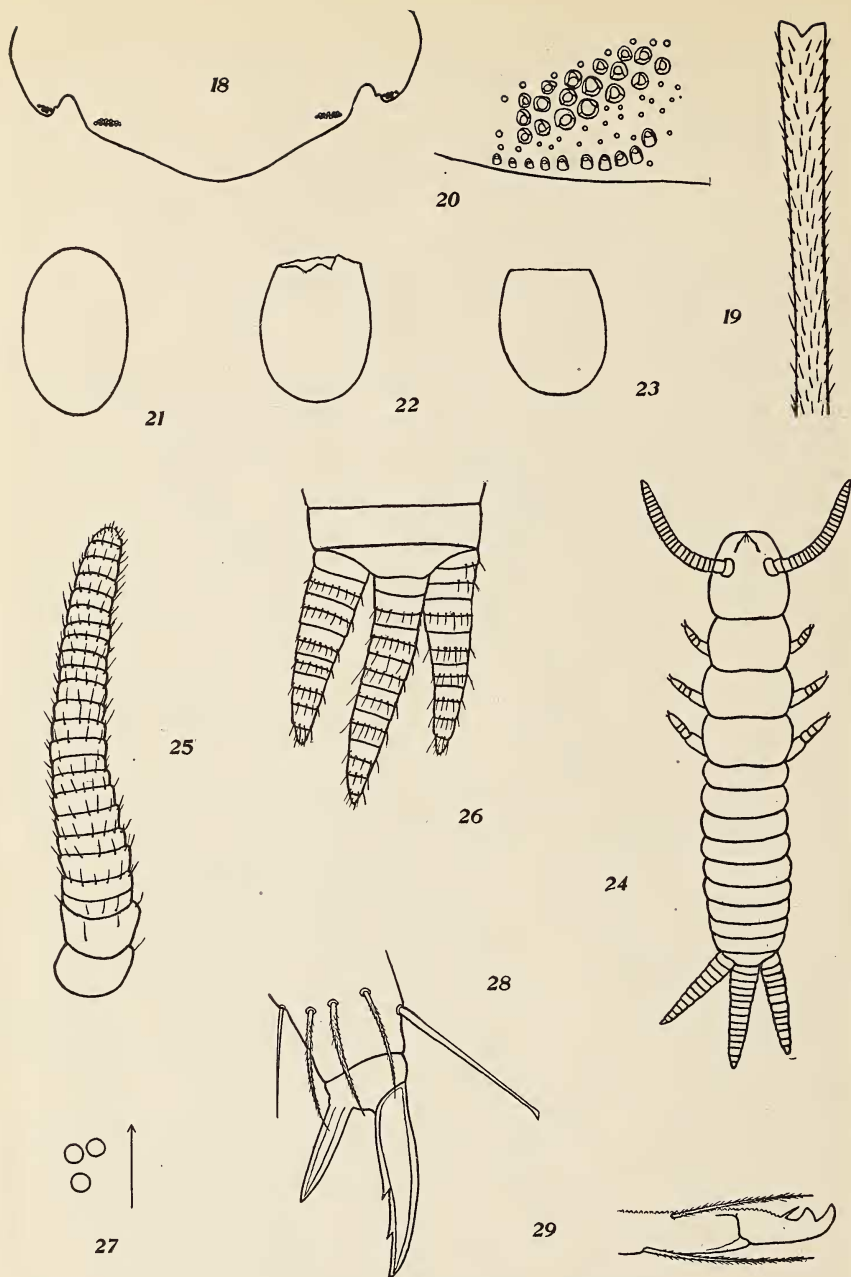


Plate V. 18, *Acrotelsa galapagoensis*, ventral plate of seventh abdominal segment of female, $\times 14$. 19, *Acrotelsa galapagoensis*, seta from front, $\times 240$. 20, *Acrotelsa galapagoensis*, setal sockets of left outer dorsal comb of fourth abdominal segment, $\times 110$. 21, *Lepismid*, outline of egg, $\times 15$. 22, *Lepismid*, egg shell, $\times 15$. 23, *Lepismid*, egg shell, $\times 15$. 24, *Lepismid*, nymph, reconstructed from exuviae, $\times 25$. 25, *Lepismid*, right antenna of nymph, $\times 100$. 26, *Lepismid*, telson, cerci and pseudocercus of nymph, $\times 53$. 27, *Lepidocyrtus intermixtus*, eyes of left side, $\times 320$. 28, *Lepidocyrtus intermixtus*, right hind foot, $\times 1260$. 29, *Lepidocyrtus intermixtus*, left mucro, $\times 1260$.

1 + 1; abd. 10, 3 + 3 large marginal clusters and sometimes a small fourth distal pair (fig. 13). Of these just enumerated, lateral clusters occur on abd. 1-9 inclusive. Most of the clusters and combs contain many macrochaetae (fig. 20). The thoracic sternites are fringed with stiff yellow setae; the prosternum has three combs on each side, the meso- and metasternum each two. On the abdomen, ventrally, there is a setal cluster on each side of the articulation of each stylus on abd. 3-7, inclusive (fig. 18), the mesal clusters forming combs; and a mesal comb on abd. 8 (figs. 16, 17).

Scales simple, varying greatly in form: obovate, ovate, suboval to orbicular, etc., very minutely striate. The scales are sometimes colorless but usually pigmented with brown, especially apically; the fine close striae give interference colors of violet or blue.

Length of largest female, 18 mm.; width of mesonotum, 5 mm.; length of antennae, 25 mm.; of a lateral cercus, 15 mm.

Length of largest male at hand, 9 mm.

Six specimens, collected by Prof. W. M. Wheeler. Two females, Indefatigable, April 8th, 22nd, under stones on beach (Nos. 2188, 2306). One female, Daphne Major, April 24th (No. 2333). One male, South Seymour, April 25th, (No. 2423). Two males, James Island, April 5th (pinned).

The types described by Banks were taken on Hood Island in May.

A. galapagoensis is closely related to the West Indian species *A. gigantea* Esch., as regards the number of styli, the form of the labial palpus, etc., but differs from the latter species in regard to the color of the legs, styli and palpi, and in some other respects, particularly in having no median fold on the posterior border of the seventh ventral plate of the female.

The genus *Acrotelsa* contains the largest known lepismids. *A. gigantea* Esch. attains a length of 21 mm., and *A. galapagoensis* Banks, 20 mm.

LEPISMID EGGS AND NYMPHS.

(Plate V, figs. 21-26).

Mr. Beebe collected, on South Seymour Island, April 22nd, hundreds of egg shells, which were at the time correctly identified by Professor Wheeler as lepismid. These were found under a slab of lava rock upon a small amount of earth. They were not attached to the stone but were loose, on and in the thin layer of soil.

These were shells of eggs that had hatched. Among them was rarely an unhatched egg, like that represented in figure 21. The shells are brownish yellow, the eggs broadly elliptical to subovate, and smooth externally. At one end, the narrower end of the subovate egg, the nymph escapes by pushing off a cap, leaving usually an irregular torn margin (fig. 22), though occasionally a straight edge (fig. 23), indicating a pre-existing line of weakness. The eggs average 1.45 mm. in length by 0.9 mm. in width. Frequently several egg shells are held together in a cluster by means of a gelatinous substance.

Among the egg shells were hundreds of minute lepismid skins, and occasionally a skin of the same kind could be seen within an egg shell. These skins had all belonged to nymphs of practically the same size and were probably exuviae of the first molt. The more complete skins showed a median dorsal split extending always the length of the head and thorax and frequently to the end of the abdomen. Though all the skins were more or less distorted and fragmentary, it was not difficult to reconstruct from them the form of the nymph, shown in figure 24.

As little is known about the early stages of lepismids, except what Heymons has recorded, it is worth while to describe this immature form, in comparison with adult lepismids.

The head is very large in proportion to the body. The thoracic segments are equal and simple, and the thorax but slightly broader than the abdomen; the latter being only one fourth longer than the thorax, with parallel sides scarcely narrowing posteriorly, and with segments mostly subequal. There is no imbrication of the abdominal sclerites, which simply meet, edge to edge. In the exuviae, at least, there are no traces of external organs of reproduction, with the exception of a median slit dividing the ninth ventral segment into halves almost to the posterior border of the eighth. The mouth parts are peculiar, forming a cone; there being an enclosing ventral sheath (probably the labium, as in Hemiptera) which is split along the median dorsal line—a condition that I have not as yet encountered in any adult lepismids. The antennae (fig. 25), inserted close together, are short and stout, only three fifths longer than the head, with twenty-four segments (the adults would have very many), the segments being mostly subequal in length. The cerci and pseudocercus (fig. 26) are slightly longer than the head, stout, and elongate-conical; the cerci having thirteen segments (rarely twelve) and the pseudocercus fifteen (the adults would have many more). There are no traces of styli. The legs have short stout segments, like those of an embryo; the tarsus bearing three claws, as in all lepismids. The setae of the body and legs are sparse, short and stiff. No scales are present, though the cuticula is elevated into minute, closely-set papillae.

Characters of generic value are practically absent in these nymphs; though they might possibly be found in the mouth parts. The form of the telson is one common to many genera of Lepismidae.

Clues to the identity of these nymphs were found, however, in two cast skins of well-grown individuals that occurred among the egg shells and small exuviae. These two larger skins were far from perfect, but showed the same peculiar kind of mouth parts and the same form of telson found in the smaller skins; and exhibited, moreover, well developed setal combs, in which the macrochaetae were still in place. These large setae were exceptionally long, bilobed apically, and strongly fringed. The large skins showed lepismid eyes, of which I did not detect any traces in the small exuviae; corneae may have been present in the latter, but if so, were obscured by foreign matter and by the distortion of the cuticula. There were seven pairs of styli.

The eggs and nymphs do not belong to either of the two species of lepismids described here; for the form of the telson excludes them from *Acrotelsa* and the fringed setae from *Heterolepisma*. The number of dorsal setal combs, the number of macrochaetae in each comb (inner dorsal, 2; outer dorsal, 4 or 5; lateral, 4 or 5) and the number of styli, indicate that the species belongs in or near the genus *Ctenolepisma*.

***Lepidocyrtus intermixtus* sp. nov.**

(Plate V, figs. 27-29).

White throughout (excepting the black eye-spots), or white with a faint pigmentation of irregular spots of blue, frequently surrounding colorless round or oval spots made by the hypodermal nuclei. The pigment consists of minute round separate granules of blue, and when present occurs scatteringly on the following regions: head, dorsally, laterally and ventrally; an imperfect V-shaped line connecting the ocular spots anteriorly; mesonotum, antero-dorsally and laterally; metanotum, dorsally and laterally; abd. 1-3, a feeble pigmentation dorsally and laterally; abd. 4, dorsally except on anterior fourth, laterally, also ventrally on each side of the middle region; abd. 5, a little pigmentation dorsally. Antennae white throughout, or all segments spotted with blue but colorless apically. Legs slightly pigmented basally, otherwise colorless. Furcula white throughout.

Eyes (fig. 27) three on each side, equal, not on separate pigment spots, but on a common black spot, which is small and roughly elongate-triangular. Antennae slightly longer than the head, with segments in relative lengths about as 10:16:17:33; first two segments subcylindrical, third subclavate, fourth narrowly elliptical. Mesonotum covering the prothorax but not projecting over the head; with a dense anterior fringe of divergent setae, feebly clavate and naked. Fourth abdominal segment more than twice as long as the third (from 2.1 to 2.6 times as long). Fifth and sixth abdominal segments with curving fringed setae. Claws minute. Unguis (fig. 28) almost straight, without lateral teeth, with inner margin subequally bidentate, there being one tooth in the middle and an-

other one fourth from the apex. Unguiculus extending as far as the proximal tooth of the unguis, straight, sublanceolate. Tenent hair feebly knobbed. Furcula attaining the ventral tube. Manubrium and dentes subequal in length, with short curved fringed setae dorsally, and scales ventrally. Dentes crenulate dorsally on the proximal three fourths, the distal fourth bearing minute serrations, which are continued beyond the dens on the dorsal side of the mucro (fig. 29). Mucro minute, tridentate; apical and anteapical teeth subequal; proximal tooth oblique as usual, spine-like, in the middle of the dorsal margin. A few long fringed setae extend from the dens nearly or quite to the end of the mucro.

A dorsal pair of erect subclavate fringed setae was seen on the second abdominal segment of one specimen, and such sensory setae doubtless occur normally on other segments also. Very few scales had remained on the specimens; these scales were oval or elliptical, with obscure, extremely minute and close, short, irregular, longitudinal striae. Maximum length of specimens, 1 mm.

Twenty-two syntypes. South Seymour Island, April 22nd. This little collembolan was taken incidentally by Dr. William Beebe; it appeared among the hundreds of lepismid egg shells that he collected.

This form, like a few other species of *Lepidocyrtus*, approaches the genus *Sira* as regards the shortness of the mesonotum. As the furcula bears ventral scales, however, the species is referred to *Lepidocyrtus*.

This is one of the series of scientific papers of the Harrison Williams Galapagos Expedition, under the directorship of William Beebe, sent out by the Department of Tropical Research of the New York Zoological Society. The general account and narrative of the expedition, together with the natural history and photographs of the fauna, are embodied in a volume by William Beebe, published by G. P. Putnam's Sons, under the auspices of the Zoological Society. Its title is "Galapagos; World's End."